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Publication Title:

Over-the-air re-programming of radio transceivers

Abstract:

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US 5613204 A **US 5109403 A**

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(54) Abstract Title
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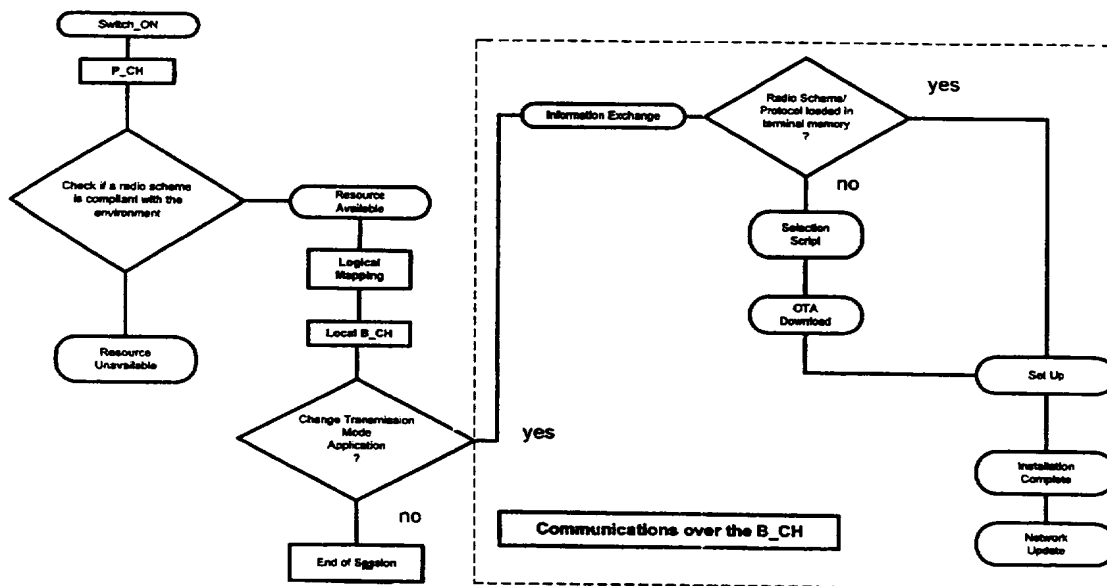


Figure 2

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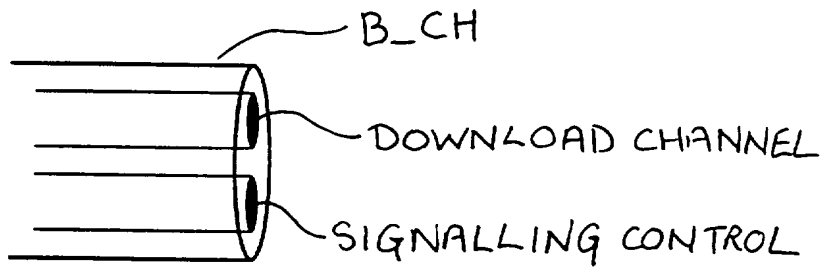


Figure: 1

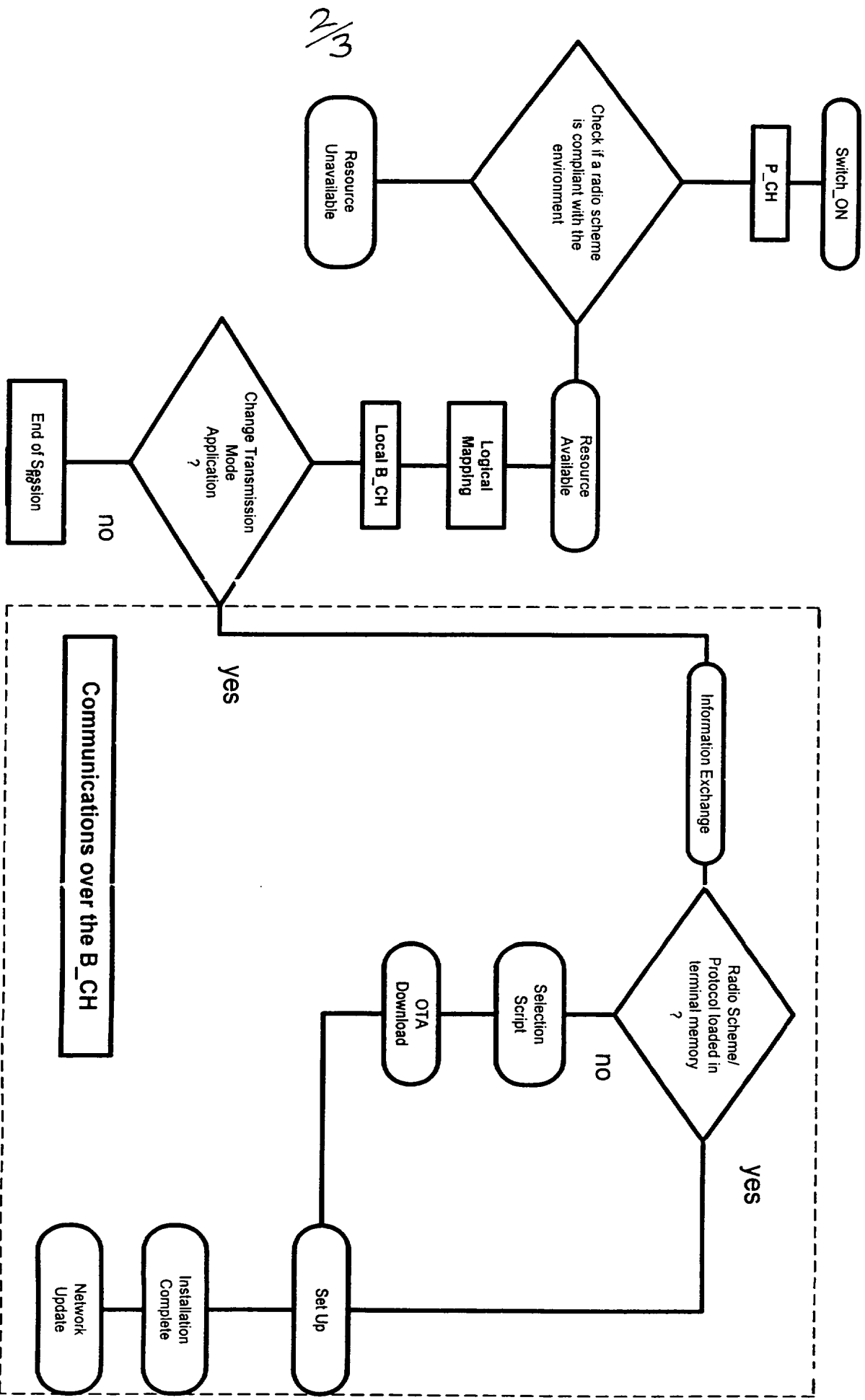


Figure 2

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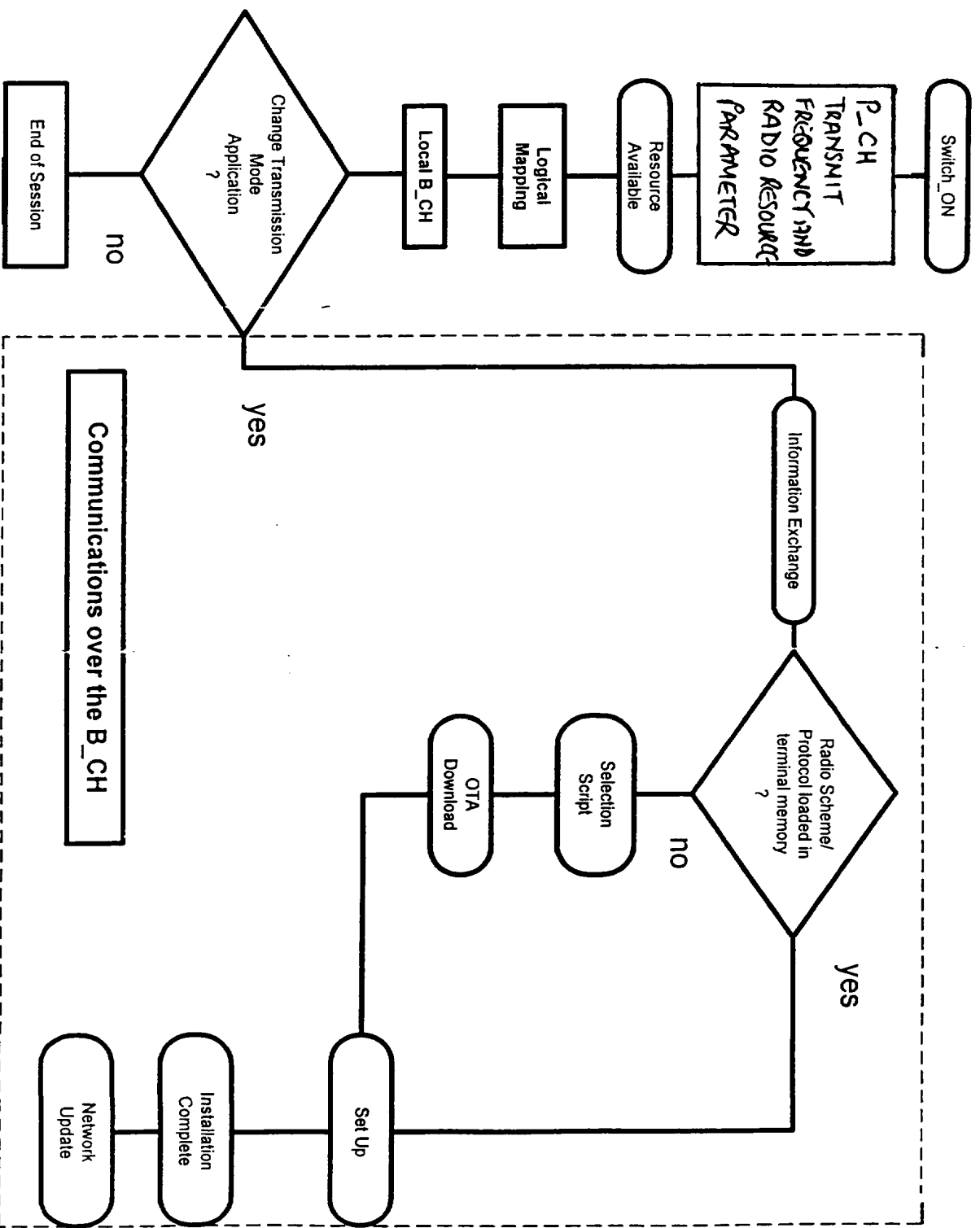


Figure 3

Over-the-air re-programming of radio transceivers

This invention relates to radio transmitter/receivers and in particular it relates to a method of re-programming radio transmitter/receivers over-the-air.

A radio transmitter/receiver (transceiver) such as a radiotelephone is designed for operation with particular types of networks such as GSM 900 or DCS 1800. Intended use of the radiotelephone with a particular network(s) in a restricted geographical area, however, requires that the telephone be configured so as properly to communicate with the particular network (s). The user of a radiotelephone will usually have a telephone which has been configured for communication with a so called "home network". The home network is the local network usually most used by the subscriber.

The area within which a user of e.g. a GSM radiotelephone may operate, however, is considerable and is not limited to the home network but may be used on many other networks throughout the world. Use of a handset outside the home network is known as "roaming".

When the radiotelephone is to be used in roaming it is often necessary for it to have a configuration different to that for use with the home network. It is possible for re-configuration of radio transmitter/receivers to be effected by means of signals received across the air interface.

It is also convenient for the radio to be re-configurable over the air interface so as to support different types of communication and user applications e.g. addition of address book manager, whether or not it is located in the home network.

Over the air re-programming of radio receivers is well known in the art and reference may be made to US patent 5 381 138 for example. The capability to obtain programming data from a network is particularly useful for a roaming radio transmitter/receiver.

When beginning operation in an area for which the radiotelephone is not configured and it is required to download the data for reconfiguration from one of the available networks, a communication link must first be established with the network of interest. It has been proposed that a pilot channel be established in all areas from which the roaming radiotelephone may obtain the data necessary for reconfiguration.

A pilot channel of this type, however, will require a relatively large bandwidth to allow a sufficiently fast transfer of the data required.

According to the invention there is provided a method of downloading reprogramming data from a network for installation in a radio transmitter/receiver comprising initial communication from a first dedicated channel of relatively small bandwidth broadcasting at least the frequency and radio access parameters of a second channel of relatively large bandwidth from which reprogramming data may be downloaded.

Examples of the invention will now be described in more detail with reference to the accompanying figures in which

figure 1 Illustrates the logical structure of the bootstrap channel

figure 2 Is a flow diagram of a reconfiguration process

figure 3 Is a flow diagram of an alternative reconfiguration process

A roaming radio transmitter/receiver (mobile) is located in a region served by one or more networks and the user wishes to communicate with a network from which he can obtain reprogramming data and subsequently begin communicating with the network in the communication mode selected.

A pilot channel broadcast is maintained in the region and contained in the pilot channel broadcast there is at least sufficient information for the mobile to connect to a second channel which we shall call the bootstrap channel. Conveniently the pilot channel will be broadcast in all regions over a standardised radio interface. Only a small bandwidth is required for the pilot channel because of the small amount of information contained in the broadcast.

The small bandwidth requirement makes the task of standardisation much easier with respect to the pilot channel. The wider bandwidth channels are more conveniently assigned locally for ease of implementation.

The Pilot Channel (P_CH) broadcasts a list of sets of parameters corresponding to networks available in the region. The mobile receives the network transmission through the P_CH. If the existing configuration of the mobile is matched to the available regional radio schemes, then a second channel the bootstrap channel (B_CH) is logically mapped onto the selected transmission mode. The base station and mobile exchange information over this dedicated logical channel.

The Bootstrap channel is logically mapped on top of one of the default modes of the terminal; a mapping of a logical B_CH onto the physical GSM channel for instance may be implemented. Once the mapping has been effected the terminal may download data from the base station. The bootstrap channels provided by each operator may accommodate differing services with regard to the applications available for downloading.

The flow diagram shown at fig 3 depicts a reconfiguration procedure.

When the mobile is switched on, it reads the Pilot Channel broadcast. The mobile must be configured to support the (standardised) radio interface of the Pilot Channel. The Pilot Channel carries local radio parameters (standards supported in the regional environment in which the mobile is located). After processing the received information, the mobile

communicates with the base station through the Bootstrap Channel, provided that the mobile has the minimum resources required by its local radio environment. Prior to the change of channel, P_CH to B_CH, a logical mapping of the Bootstrap Channel is performed within the mobile on the selected air interface.

When operation on a local B_CH transmission has been established, the user may wish to change some properties or the performance of his mobile and can request supply of the desired services from the network. If no changes are required then the mobile adopts the default transmission mode in stand-by and releases the allocated B_CH.

If the user requests a change then communication between the base station and mobile is maintained for the exchange, the nature of which will depend on the capabilities of both mobile and network. At least 3 conditions can affect the nature of this information exchange.

Firstly, the mobile may not be able to support the required software. Where the mobile is not able to support the required software, no communication channel is available to the mobile from the existing network resources and use of the mobile within the region will therefore not be possible.

Secondly, the required software may be stored already in the mobile's memory. In this situation there is no need to download a software module but the allocated B_CH connection is maintained for further operations as described.

Thirdly, the software module required to support a different type of communication or user application may need to be downloaded from the base station. Where the download of a software module is required, initially a selection script is downloaded to the mobile followed by downloading and installation of the required software.

When the installation of the required software into the mobile has been completed, the mobile signals to the network the achievement of correct reconfiguration. On receipt of the “correct reconfiguration” signal from the mobile details of the mobile identity and its present configuration are entered on the network database (to license the product for instance) .

With reference to figure 1, the logical structure of the bootstrap channel will include 2 logical sub-channels : a download channel and a signalling control channel (S_CH). The signalling control channel assists in the reduction of errors in transmission so as to allow correct software download.

In the above example, the first channel, the Pilot Channel, is standardised and the mobile must be configured to support the radio interface for the Pilot Channel. The second (bootstrap) channel may be subject to local definition through logical mapping on a local transmission mode e.g. GSM, DECT and the mobile is not initially configured to support the radio interface for the bootstrap channel..

An example of a method of reprogramming providing greater flexibility will now be given. In this example the mobile is configured to support the radio interfaces for both the first, dedicated relatively small bandwidth (Pilot) channel and the second relatively large bandwidth (bootstrap) channel. That is to say that when the mobile is switched on in most and preferably all regions, the network can communicate with the mobile via both pilot and bootstrap channels.

In order for the mobile always to have the appropriate radio interface for the bootstrap channel then this channel would need also to be standardised (in addition to the Pilot Channel). The parameters of the bootstrap channels provided in different regions may have local variations in terms of e.g. allocated frequency, data rate and available user applications.

With reference to figure 3 which is a flow diagram of the reconfiguration process for this example, the mobile when switched on reads the Pilot Channel broadcast. The allocated frequency and radio resource parameters for the bootstrap channel contained in the pilot channel broadcast are processed and any required logical mapping effected. After processing the received information, the mobile communicates with the base station through the Bootstrap Channel.

The condition likely to be experienced in the previous example whereby the mobile is not able to support the required software and no communication channel is available to the mobile from the existing network resources does not apply in this arrangement. The communication via the bootstrap

channel allows the request for and supply of the software module necessary to establish communication with the network. The transfer to the bootstrap channel does not depend on the existing configuration of the mobile since the bootstrap channel is standardised in this example and the mobile is equipped to interface, via the pilot channel, with the bootstrap channel.

The services and structure offered by the Bootstrap Channel are common for both of the above examples, however, the requirements on the terminals and networks differ.

The bootstrap channel will provide the following services by means of over-the-air (OTA) reconfiguration :

capability Exchange - the terminal provides some information to the network on its current configuration and capabilities.

module Selection : at this stage the user specifies the software that his terminal requires to download. This operation could be compared to an installation script.

data download : transfer of the data. In some cases software code will have to be downloaded whilst in other cases the software may already be implemented in the mobile. In the latter case, a set-up mechanism would be sufficient to initiate the reconfiguration.

Once the mobile and the base station are synchronised on the bootstrap channel, information exchange can begin.

Claims

1. A method of downloading reprogramming data from a network for installation in a radio transmitter/receiver comprising initial communication from a first dedicated channel of relatively small bandwidth broadcasting at least the frequency and radio access parameters of a second channel of relatively large bandwidth from which reprogramming data may be downloaded.
2. A method of downloading reprogramming data from a network as in claim 1 where first, dedicated relatively small bandwidth channel has a standard radio interface common to many network locations.
3. A method of downloading reprogramming data from a network as in claim 2 where second relatively large bandwidth channel has a standard radio interface common to many network locations.
4. A method of downloading reprogramming data from a network as in claims 1 to 3 where first, dedicated relatively small bandwidth channel broadcasts a list of sets of parameters corresponding to networks available in the region.
5. A method of downloading reprogramming data from a network as in claim 1 where the radio transmitter/receiver is configured to support the radio interfaces for both the first, dedicated relatively small bandwidth channel and the second relatively large bandwidth channel.



Application No: GB 9802545.5
Claims searched: 1 to 5

Examiner: Glyn Hughes
Date of search: 17 August 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4L (LDSC, LDSU, LECC, LECX)

Int Cl (Ed.6): H04Q 7/32, 7/38

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	US 5613204 (HABERMAN ET AL) see in particular column 15 lines 48 to 50	1
X	US 5109403 (SUTPHIN) see abstract	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.